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# NASA CR-170572

FINAL REPORT

for

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National Aeronautics and Space Administration  
Goddard Space Flight Center  
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AE AERONOMY STUDIES



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Research under this contract was conducted initially at Yale University and subsequently at The University of Michigan and Utah State University. Scientists who have at one time or another contributed to this research include J. C. G. Walker, R. W. Schunk, P. G. Torr, M. R. Torr, J. P. St. Maurice, P. G. Richards, T. P. Dachev, as well as graduate students and post-doctoral scholars. Over the years the members of this theoretical team have participated fully in meetings of the AE Aeronomy Team, presenting results at AE Team Meetings, as well as at numerous national and international scientific meetings.

Research under this contract has been principally devoted to the elucidation of chemical processes in the thermosphere and ionosphere using AE data. These data have been analyzed and interpreted in such a way as to verify and correct laboratory measured rate coefficients, obtain values for rate coefficients not measured in the laboratory, and to reveal and correct inadequacies in existing models of thermospheric chemistry. This activity has stimulated new work in the laboratory measurement of rate coefficients by revealing errors in existing measurements and by suggesting new measurements that need to be made. Our present understanding of the chemistry of the ionosphere and thermosphere is based largely on the chemical schemes and rate coefficients deduced from AE data. With a few exceptions we can now claim to understand the chemistry of the thermosphere and ionosphere as precisely as permitted by the measurement errors of the AE instruments. These achievements in the area of thermospheric and ionospheric chemistry are summarized in the three review papers attached to this report.

Theoretical research under this contract has dealt also with dynamical and optical processes in the thermosphere, auroral processes, and energy input. A list of publications resulting from research supported by this contract is attached.

The AE program set new standards for quantitative research in physical and chemical processes in the thermosphere and ionosphere and led to important organizational innovations in the methods of studying the upper atmosphere. The success of the chemical and energy balance aspects of the program made possible the present focus on dynamical and electrodynamic interactions in the thermosphere and ionosphere. The Dynamics Explorer program is a logical successor to AE, which is currently building on the very substantial achievements of the Atmosphere Explorer program.

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